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ABSTRACT

A study tested the hypothesis that learning disabled (LD), specifically reading disabled, children differ from "normal" children in their ability to acquire automatic perceptual processes. The subjects were 16 third grade and 15 sixth grade students, of whom 7 third grade and 3 sixth grade students were classified as LD. LaBerge's letter matching task, which involves identifying familiar and unfamiliar items, was presented to the children on an Apple II microcomputer. Reaction time and accuracy data were collected on three consecutive days. Analyses of correct reaction times data revealed a significant grade X day interaction. Simple effects tests indicated that only the reaction time of the third graders decreased across days. Predicted differences in the acquisition of automatic processes between LD and normal children were not found. A second study was conducted to replicate LaBerge and thus insure methodological equivalence. The procedure from the first experiment was repeated with 16 college students. Analyses of correct reaction time data replicated LaBerge's findings. (Author/FL)

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Automatic Processing

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Automatic Processing in Normal and
Learning Disabled Children

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Running Head: AUTOMATIC PROCESSING

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Abstract

The purpose of this project was to test the hypothesis that learning disabled (LD), specifically reading disabled, children differ from "normal" children in their ability to acquire automatic perceptual processes. The subjects were 16 third-graders and 15 sixth-graders. Of these, seven third-graders and three sixth-graders read at least one year below grade level and were classified as LD. LaBerge's (1973) letter-matching task was presented on an Apple II microcomputer. Letter-matching stimuli included familiar (b,b) and unfamiliar (v,v) items. Reaction time and accuracy data were collected on three consecutive days. Analyses of correct reaction time data revealed a significant Grade x Day interaction. Simple effects tests indicated that only the reaction time of the third graders decreased across days. Predicted differences in the acquisition of automatic processes between LD and normal children were not found. A second experiment was conducted to replicate LaBerge and thus insure methodological equivalence. The procedure from the first experiment was repeated with 16 college student subjects. Analyses of correct reaction time data replicated LaBerge's findings.

Automatic Processing in Normal and
Learning Disabled Children

Many theorists propose that learning disabled (LD) children manifest selective-attentional difficulties. These difficulties could interfere with the consistent processing of information required for the acquisition of automatic processing skills (LaBerge & Samuels, 1974; Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977). Differences in the use of automatic reading processes appear to differentiate good and poor fourth-grade readers (Byrd, Okwumabua, Morris, & Gholson, 1982). Good readers process intraword sources of information (e.g. initial letter) in a relatively automatic, attention-free manner. In contrast, poor readers process intraword sources of information in a controlled, attention-demanding manner. One purpose of this project was to gather evidence to support the hypothesis that LD, specifically reading disabled, children differ from "normal" children in their acquisition of automatic letter processing skills. A second purpose was to gather evidence to support the hypothesis that differences between normal and LD children are greater for younger than older groups of children. This expectation was based on the assumption that older LD children would have developed the attentional capabilities necessary to acquire automatic processes. Younger LD children, in contrast, would not be

expected to have developed sufficient attentional capabilities (Hallahan, Kauffman & Ball, 1973).

LaBerge's (1973) letter-matching task was used to measure the acquisition of automatic perceptual processes in third and sixth grade normal and LD children. According to LaBerge, an attentional expectancy is formed when the subject sees a priming letter (e.g. "a"). Then, when a pair of letters which are different from the letter prime appear, (e.g. "b b") the subject may have to switch attention to process them. However, if the letters are processed automatically attention switching would not be required. Reaction time to familiar letters should be very fast (processed automatically) and impervious to practice effects. In contrast, when unfamiliar letters first appear, the subject does not process them automatically and attentional switching is required. Reaction time to process unfamiliar, new letters should be longer than for familiar letters. As the unfamiliar letters become familiar with practice, reaction time should decrease. The decrease in reaction time to process new letters across days is assumed to represent the acquisition of automatic processing skills (LaBerge, 1973).

Experiment I

Method

Subjects. The subjects were 16 third-graders (mean age = 8.5 years, range = 7.9 to 9.3 years) and 15 sixth-graders (mean age = 11.5 years, range = 10.7 to 12.8 years). Of these, seven third-graders and three sixth graders read more than one year below grade level and were classified as LD. Children with an IQ below 75, as measured by the Peabody Picture Vocabulary Test-Revised (PPVT-R) (Dunn & Dunn, 1981) were excluded from the study. Subjects were recruited from a local remedial reading program, a recreational camp, and a public elementary school. There was some difficulty obtaining sixth-graders who met the criteria for LD classification. All subjects were paid two cents for every correct response on the letter-matching activities.

Materials. LaBerge's (1973) letter-matching task was presented to the subjects on an Apple II microcomputer. The task was a successive matching task which involved primary and secondary types of trials. Primary trials consisted of a priming letter (e.g. "a") that appeared at the top of the computer screen followed by a second letter (e.g. "a,e,i") at the bottom of the screen. In secondary trials, the priming letter (e.g. "a"), was followed by a pair of familiar ("b b") or unfamiliar ("V V") letters. The letters in the second pair were presented 4 cm apart

at the bottom of the screen.

Procedure. The children participated in the experiment for four consecutive days. On the first day, reading level and intelligence level data were collected using Johns' Basic Reading Inventory (Johns, 1981) and the Peabody Picture Vocabulary Test-Revised (Dunn & Dunn, 1981). For the next three days, LaBerge's letter-matching task was presented and reaction time and accuracy data were collected. Instructions were presented on the screen. On primary trials the children were instructed to respond by pressing the space bar on the Apple II keyboard only when the letters that appeared on the top and bottom of the screen matched. On secondary trials the children were instructed to respond when the two letters presented in the pair at the bottom of the screen matched. Subjects completed six blocks of randomly ordered practice trials. Each block contained 30 trials. For the remaining days, they completed a short practice block and two test blocks. The test blocks consisted of 56 trials. On each day, one test block contained unfamiliar letter trials, while the other contained familiar letter trials. All trial events and data collection were controlled by the microcomputer. The children received feedback (a small beep) when they responded correctly (i.e., the letters matched) on primary trials within a criterion response latency. The criterion response latency was their mean

response latency from the immediately preceding block plus 20 msec (see LaBerge, 1973). The children were paid two cents for each beep. They lost four cents for slow or incorrect responses (i.e., no response when the letters matched).

Results and Discussion

Correct reaction time and accuracy data were submitted to a $2 \times 2 \times 2 \times 2$ (Grade $\times$ Group $\times$ Day $\times$ Stimulus Type) analysis of variance. As may be seen in Figure 1, the analysis of correct reaction time data revealed a significant Grade $\times$ Day interaction $F(1,27) = 6.06, p < .05$. Simple effects tests (Kirk, 1968) indicated that only the reaction time of the third graders decreased across days, $F(1,14) = 18.46, p < .001$. There were no significant differences between familiar and unfamiliar types of stimulus letters. Analyses of accuracy data revealed a main effect for stimulus type $F(1,27) = 5.74, p < .05$. There were more errors made for the familiar ($M = 7.5$) than the unfamiliar ($M = 7.2$) letters. This was consistent with LaBerge's findings.

The predicted differences in the acquisition of automatic processes between LD and normal children were not revealed. The only differences obtained were grade level differences. Two explanations seemed possible. First, LD and normal children did not differ in terms of the processes measured. Secondly, there may have been methodological differences in applying LaBerge's

task. In order to evaluate methodological equivalence, a second experiment was conducted to replicate LaBerge (1973).

Experiment II

Method

Subjects. The subjects were 16 college students (mean age = 19 yrs. range = 18 to 24 years) with an equal number of females and males. All students were recruited from Introductory Psychology courses at a university in central Oklahoma. They received extra course credit and were paid according to the performance criteria outlined in Experiment I (i.e. two cents for each correct response).

Materials and Procedure. The materials and procedure were exactly like those of Experiment I, except intelligence and reading level data were not collected.

Results and Discussion

Analyses of correct reaction time data revealed significant main effects for stimulus type, $F(1,15) = 8.31, p < .01$ and days $F(1,15) = 14.44, p < .01$. As may be seen in Figure 1, subjects responded significantly faster on the second day ($M = 403.55$) than on the first day ($M = 453.22$). They were also significantly faster when responding to familiar letters ($M = 406.48$ msec) than unfamiliar letters ($M = 432.30$ msec).

The interaction of Stimulus Type x Day noted by LaBerge was

not revealed; however, the current experiment was not conducted for as many days as that of LaBerge. Analyses of the accuracy data did not reveal any stimulus type or day effects.

The letter-matching task used in the present investigation appeared to be equivalent to LaBerge's (1973) task. The data from Experiment II were similar to those of LaBerge. Thus, the findings from Experiment I suggest that LD and normal children do not differ in their acquisition of automatic letter processing skills. The failure to detect the predicted differences between LD and normal children may be related to the usage of a letter-matching task rather than a more complex, word-matching task. Research is in progress using a word-matching task which will more closely approximate a reading situation.

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Mean reaction time across days for third-grade,
sixth-grade, and college students.

